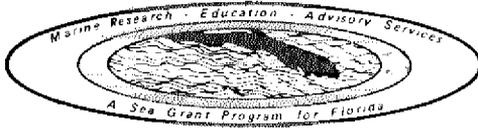


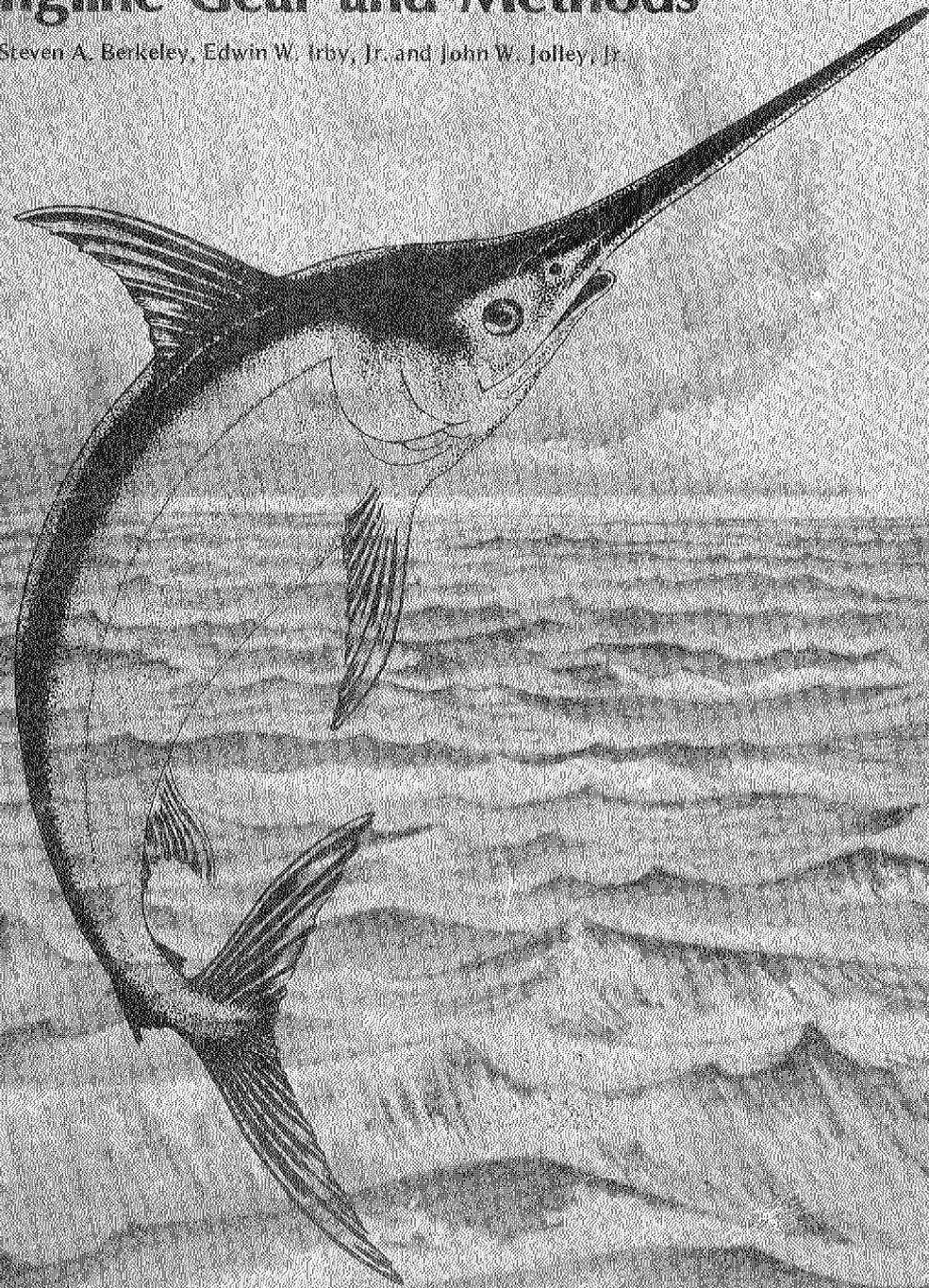
FLORIDA COOPERATIVE EXTENSION SERVICE



Marine Advisory Program

Florida's Commercial Swordfish Fishery: Longline Gear and Methods

Steven A. Berkeley, Edwin W. Irby, Jr. and John W. Jolley, Jr.



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West Palm Beach Field Station

For more information on Florida's swordfish fishery, see Marine Advisory Bulletin, "Small Boat Longlining For Swordfish on Florida's East Coast: An Economic Analysis" (MAP-15).

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FLORIDA'S COMMERCIAL SWORDFISH FISHERY: LONGLINE GEAR AND METHODS

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INTRODUCTION

This is the first of a series of planned publications to be published on the fishery and biology of swordfish. The paper briefly describes commercial fishing methods employed in the swordfish fishery. The second will deal with technical aspects of the population dynamics of the species including age and growth analysis, mortality estimates and yield estimates. The third paper will document trends in the fishery and evaluate the status of the stock based on catch and effort statistics.

The fishery for swordfish in Florida was virtually nonexistent a few years ago but now is one of the major fisheries in the state. Recreational techniques have been described extensively in the sportfishing press (see Appendix 1). Although many swordfish caught on rod and reel are sold, all truly commercial swordfishing in Florida is done with longlines. Basically, a longline consists of a main line, usually several miles long, which is supported in the water column by floats and from which baited hooks are suspended (Figure 1). The length of line attaching the buoys to the main line (called the float line or buoy line) determines the depth of the main line. This length plus the length of the hook line (gangion), the distance between buoys, position of hook line attachment and the speed at which the main line is set determine the actual depth the baits will fish. Longlines can be rigged many ways. Other than a minimum float line length

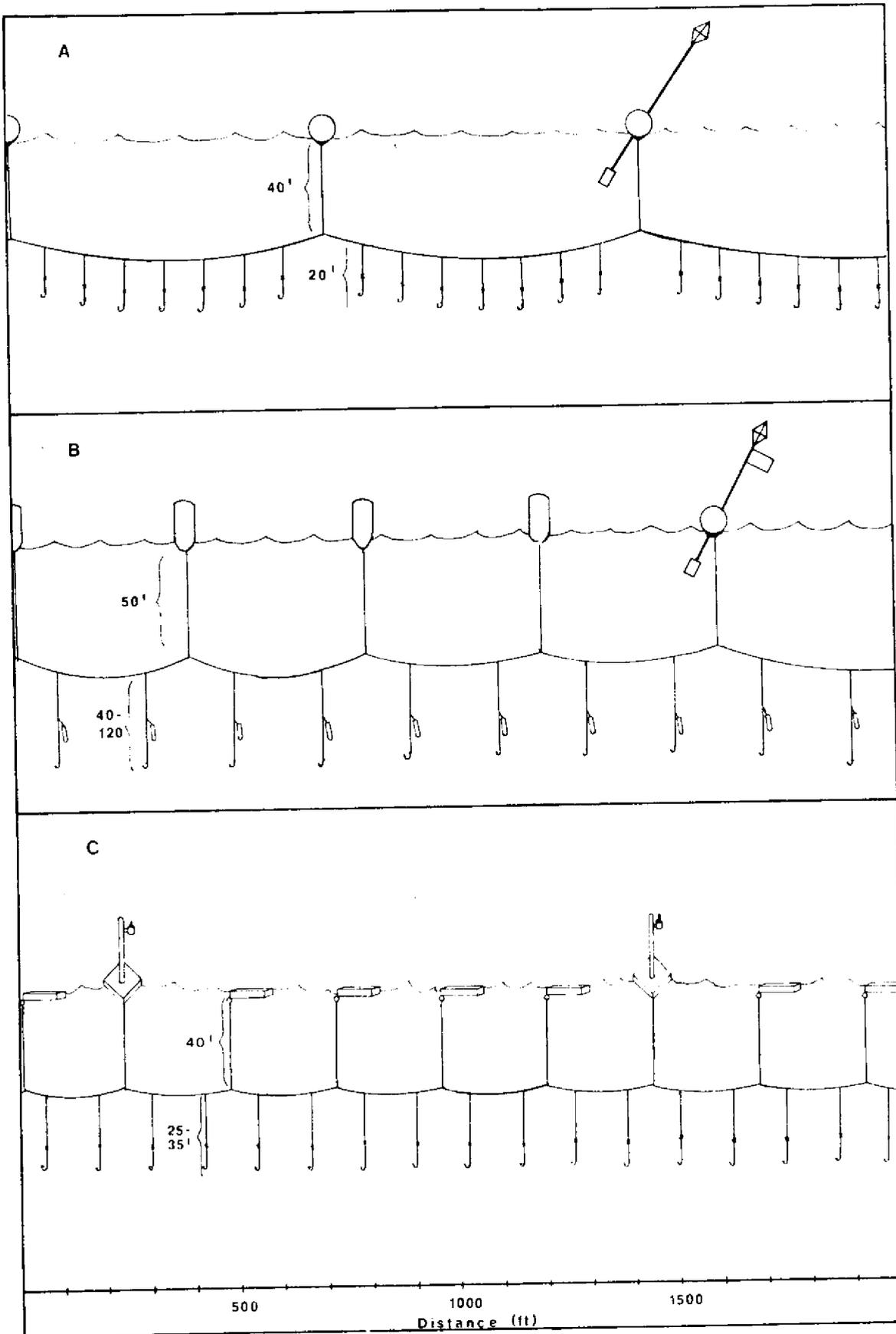


Figure 1. A) Typical New England swordfish longline; B) Typical Florida longline; C) Typical Cuban longline.

which allows ships to pass over the line without fouling it, all other dimensions and materials may vary.

In the mid 1960's, attempts were made at longlining for swordfish in the Straits of Florida but the initial efforts produced sporadic catches. These early attempts were made by New England-based commercial vessels, which moved south in the fall or early winter as catch rates declined in northern waters. The type of longline gear used in New England waters was relatively ineffective in Florida and catch rates were low. This, combined with the problem of fishing 20-40 miles of longline gear in the 2-4 knot Florida Current (Gulf Stream), discouraged swordfish fishing here. Rather than fishing in the Straits of Florida, vessels steamed into the Gulf of Mexico where they fished during winter.

At least as early as 1974, shark longliners from Port Canaveral, Florida began landing a swordfish by-catch. Word of their success attracted boats from the mid-Atlantic and New England areas. Local vessels, stimulated by the high value of swordfish and the reported success of northern boats, began experimenting with swordfish longlines. This earlier gear was relatively crude, but successful.

In 1975 Cuban-American fishermen, who had been displaced from the lobster fishery when the Bahamas closed its shelf waters to foreign fishing, began experimenting with swordfish longlining off southeast Florida. Some of these fishermen had fished for swordfish near Cuba, where a traditional swordfish fishery has existed for years. Cuban gear differed from that of New England boats, and it proved successful in catching swordfish. Because the Cuban-American fishermen fished much shorter longlines than New England fishermen, they did not encounter the problems caused by swift Gulf Stream currents. Within a year or two, word of their

fishing success had spread and many boats entered the fishery. Modifications in gear and fishing techniques were made until the present Florida longlining method evolved.

A major innovation in swordfish longlining was the introduction of the chemical light stick ("Cyalume"¹ Light). Recreational fishermen were the first to experiment with "Cyalume" lights for swordfishing in 1976. The success of the recreational anglers prompted some longliners to try light sticks and within a short time their use was widespread. These lights are attached to the leader (or snood) above the hook and glow with a cold, green light for up to 12 hours. Whether they serve to attract swordfish directly or to attract bait fish and/or squid, which in turn attract swordfish, is not known, but they are effective and are now an integral part of the Florida-style longline gear. Refinement of the gear has been the other major modification by Florida longliners; particularly the use of smaller hooks and long, single-strand monofilament leaders. Although monofilament was suggested by the Japanese in the late 1950's, its use in Florida was independently developed as a logical improvement of New England techniques by recreational fishermen who became longliners. These new techniques are now widely used, not only in Florida, but also in the Gulf of Mexico, the Carolinas and Georgia.

GEAR DESCRIPTION

Three basic types of longliner vessels fish for swordfish in Florida waters: New England, Florida, and Cuban. Although differences among these

¹ Registered trademark, American Cyanamid Company

types are becoming less distinct, their gear and techniques are still sufficiently different to warrant separate descriptions.

New England Type (Yankee Type)

New England longline vessels are usually 60 to 80 feet long and can stay at sea for at least two weeks. Boats in this class may fish anywhere along the U.S. Atlantic and Gulf coasts looking for concentrations of swordfish. Typically they fish off New England in summer and fall, and move south as winter approaches. Often, the winter is spent fishing in the Gulf of Mexico or along the Florida east coast. By May or June they work back toward New England. Fishing trips last from 10 days to three weeks during which seven to 15 nights may be spent fishing. Crew size varies between four and six.

The main line is usually from 15 to 40 miles long and is made of 3/16-5/16 inch diameter braided or hard-lay tarred nylon. Hook lines (called gangions) usually are made of tarred nylon and have a short, single or double-stranded monofilament trace (leader or snood) ahead of the hook (Figure 2). Hooks are usually large, 3/0 or 3-1/2/0 shark hooks (Figure 3). As many as 2000 hooks may be set per night, although 500-1000 is more usual. Hooks are spaced relatively close together (about 90 ft apart) with about 60 hooks per mile of main line. Bait is most often whole Atlantic mackerel (Scomber scombrus). Floats are usually inflatable polyethylene balls attached by tarred nylon to the main line (Figure 4). Fifteen or twenty-foot aluminum marker poles with strobe lights and radar reflectors (called "high flyers") are placed every one-half to one and one-half miles along the main line (Figure 6). The main line is stored on a large hydraulically-operated spool (Figure 5). The gangions and float

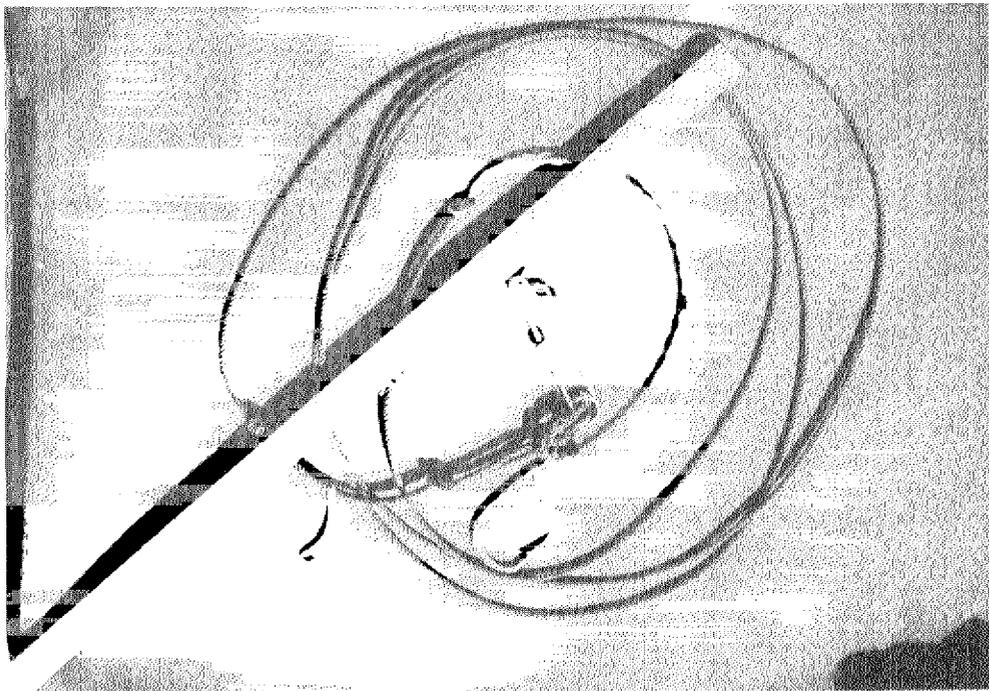


Figure 2. New England style gangion.

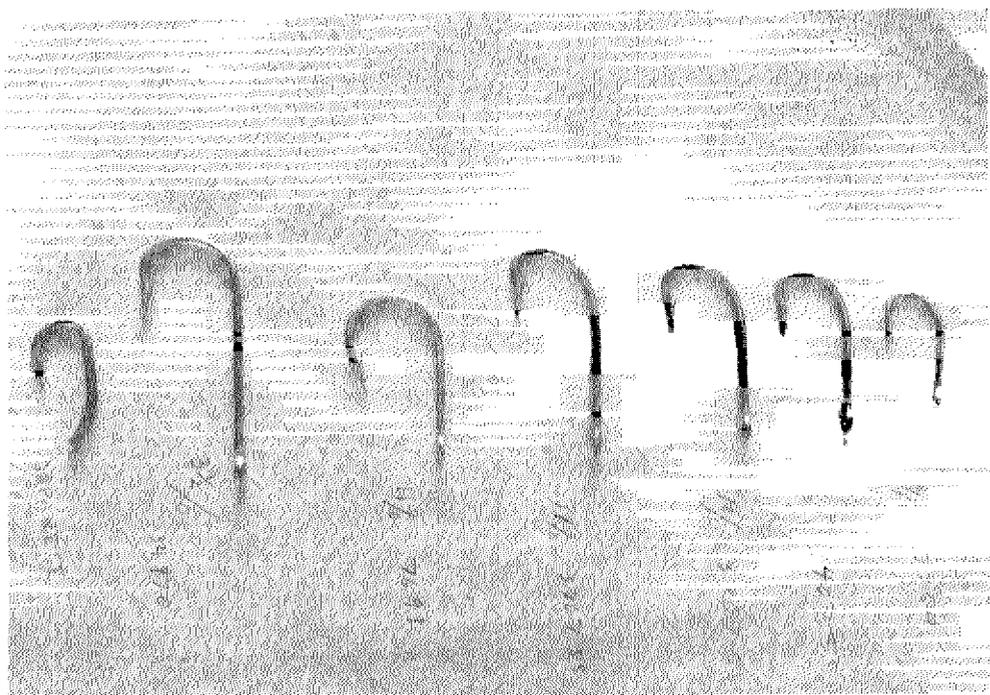


Figure 3. Hook styles and sizes commonly used.

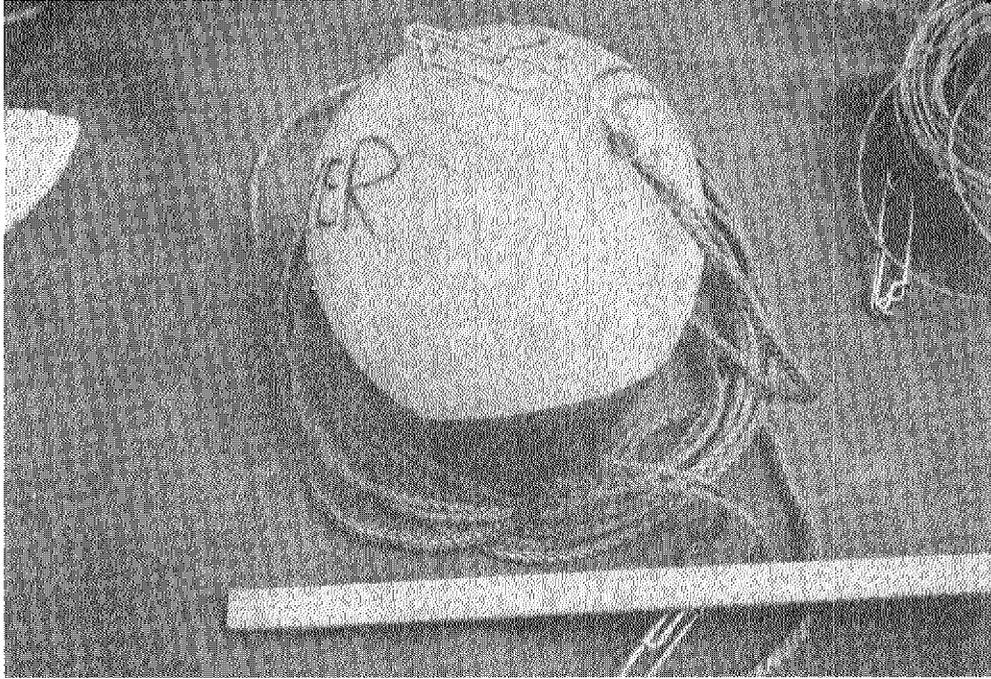


Figure 4. Inflatable polyethylene float.

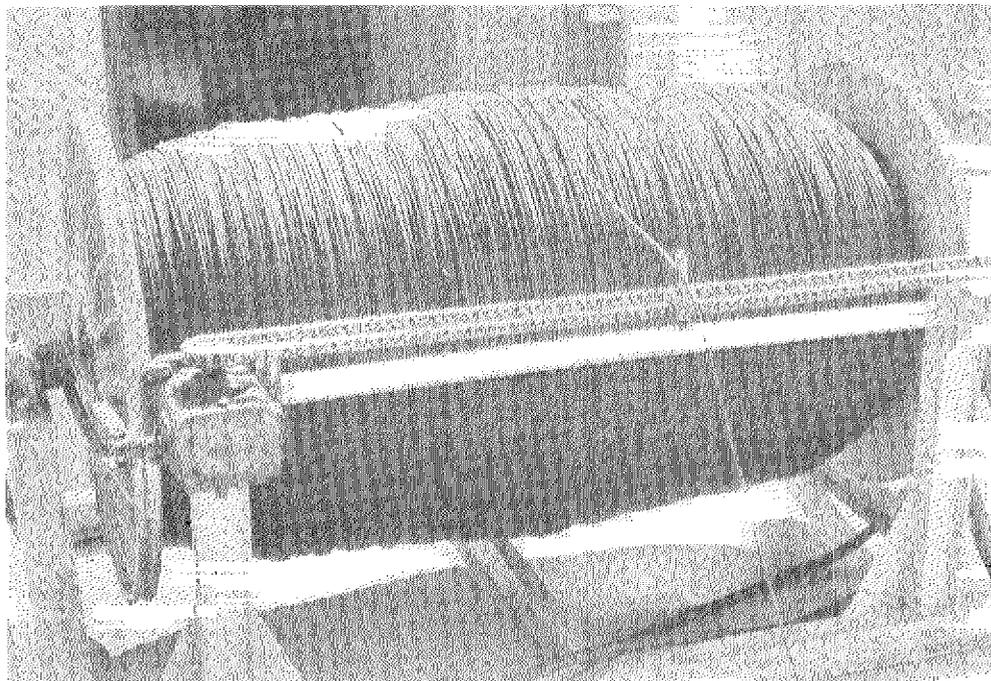


Figure 5. Hydraulically-operated spool for hauling and storing main line.

High Flyer

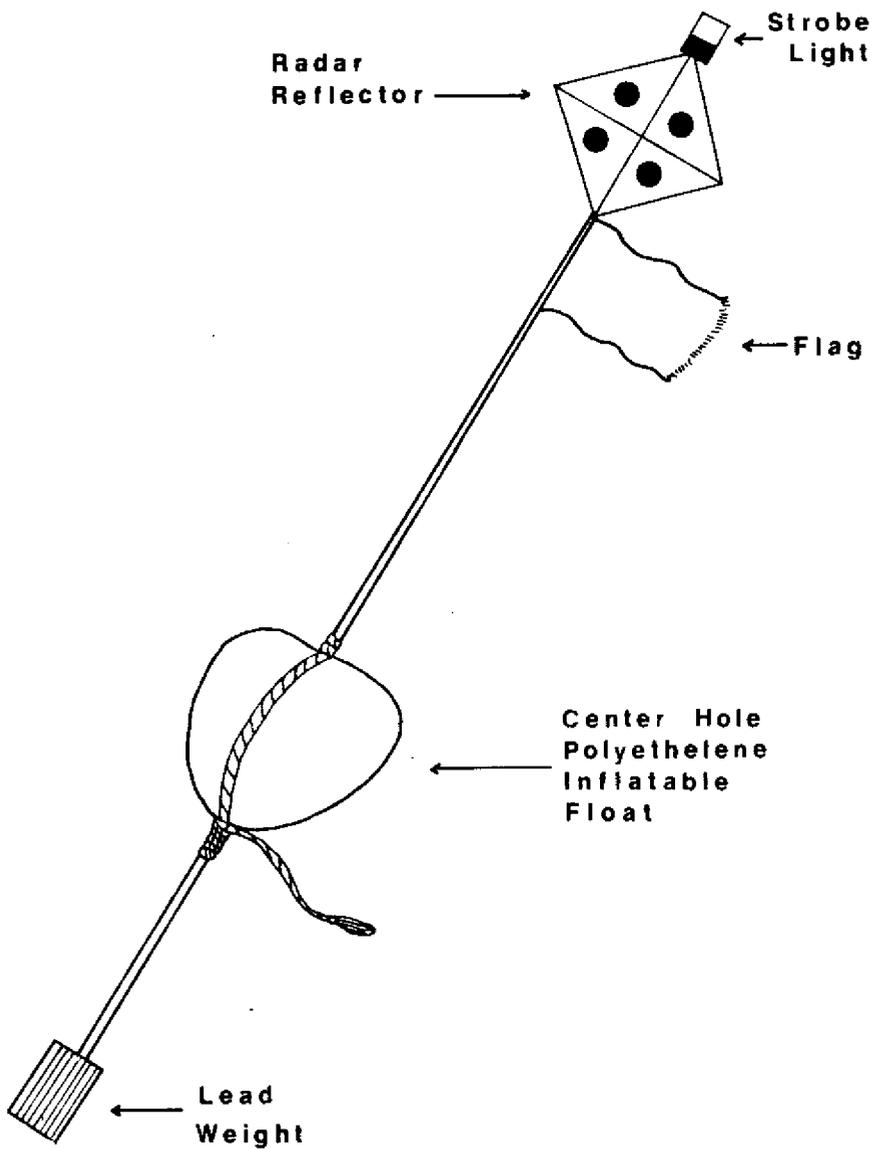


Figure 6. "High Flyer."

lines usually are stored in boxes or barrels (Figure 7). Figure 1A is a schematic drawing of a typical New England long line. A description of a traditional New England swordfish longline can be found in Publication No. 4 of the New England Marine Resources Information Program (Rhule, 1969).

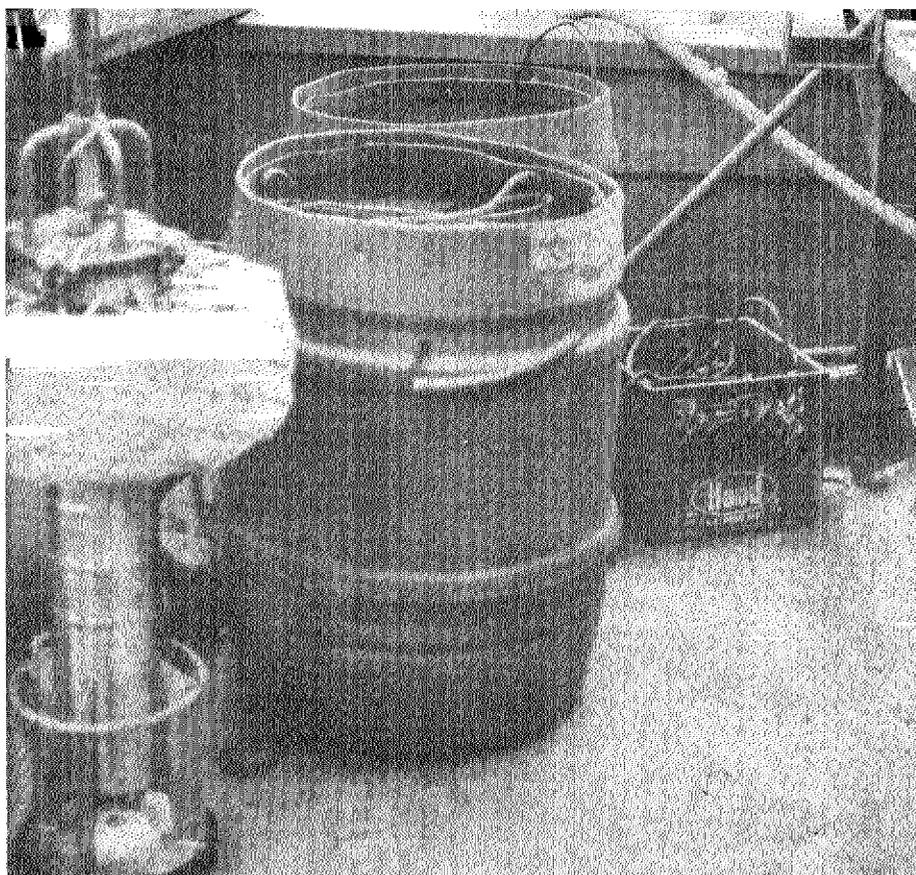


Figure 7. Barrel for storing hooks and gangions.

Florida Type (Rebel Type)

Florida longline vessels range 26 to 65 feet in length, although most are 35 to 50 feet. The typical Florida longliner fishes one or two nights per trip and carries a crew of two to four. These boats have less range than the New England type vessels and usually depart and return to the same

port every trip. If fishing is poor locally, some boats may fish from another port, but they seldom stay at sea for more than a few days.

The main line varies from 5 to 20 miles in length and is made of braided or hard-lay tarred nylon or lead-core polypropylene. Hooks are placed farther apart than on the New England longline, typically every 150-250 feet (20-30 hooks per mile). The total number of hooks varies from 100 to 400, with 200 on 10 miles of main line being about average. Hook types and sizes vary but often are smaller than those used by New England longliners. Extra-strength, big game fishing hooks of 9/0 to 12/0 size are widely used although some boats use the larger 3/0 or 3 1/2/0 shark hooks because they are less expensive (Figure 3). Gangions are 40 to 120 feet long, 300-600 lb. test single-strand monofilament. They are tied directly to the hook and attached to the main line with snap-on connectors (Figure 8). Bait is usually squid or Atlantic mackerel. A "Cyalume" light

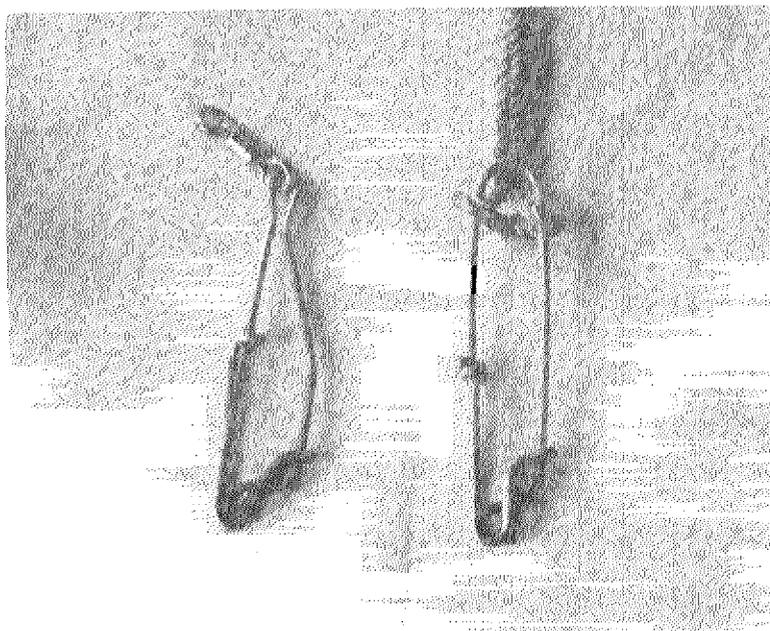


Figure 8. Snap-on connectors.

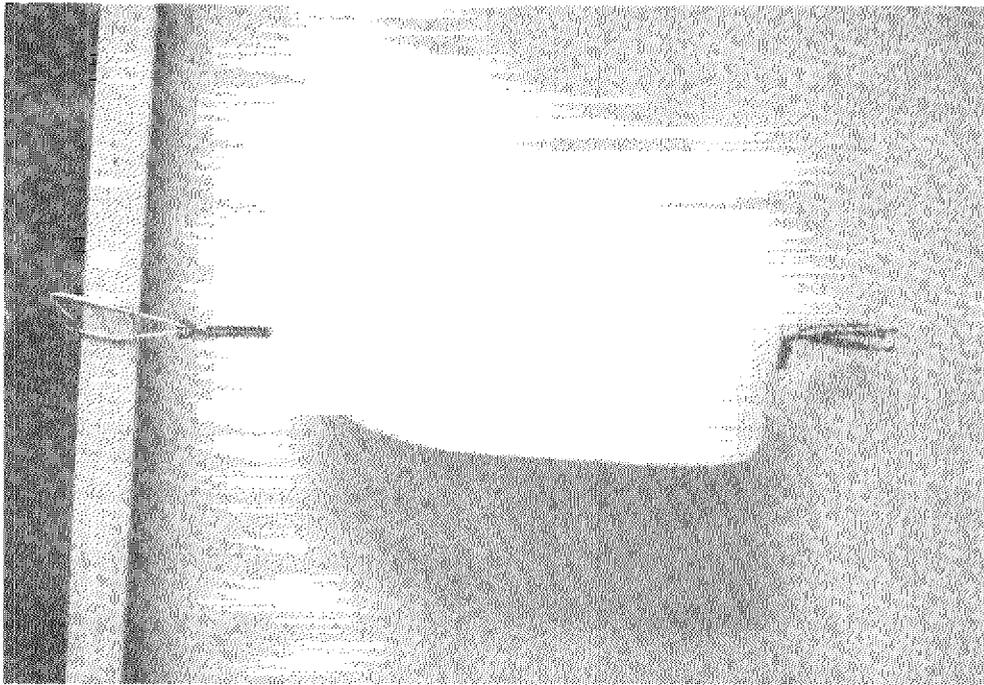


Figure 9. High density foam buoy.



Figure 10. Florida longliner with gangion spool (right) and buoy line spool (left).

stick is tied 6 to 15 feet above every bait or every other bait. Buoys are usually high density bullet-shaped foam (Figure 9). The main line is stored on a hydraulically-operated spool and often the gangions are stored on a smaller electrically or manually-operated spool (Figure 10). Buoy lines are stored separately in a box, plastic can, or on another spool. Figure 1B is a schematic drawing of a typical Florida longline.

Cuban Type

Although Cuban-American longliners were primarily responsible for establishing the Florida swordfish fishery, few, if any, fishermen now use this system. Boat sizes varied from 26 to 40 feet and carried a crew of three. Fishing trips lasted one night. The main line was from one and one-half to four miles long and was made from two strands of 300 or 400 lb. test monofilament twisted together using an electric drill. Sections of main line were spliced together. Gangions were made in the same way and tied into the main line. Leaders (snoods) were from 6 to 15 feet long and also were made from two strands of monofilament twisted together. One end was spliced to the hook, the other end had a loop spliced in it. Hooks were usually large 3/0 or 3-1/2/0 shark hooks, and were spaced every 100 to 150 feet along the main line. The total number of hooks set was from 75 to 150. Silver mullet (Mugil curema) were the preferred bait and were rigged so that they hung head down in the water with the hook protruding from the head and the tail tied to the leader. One or more Spanish sardines (Sardinella sp.) or thread herring (Opisthonema oglinum) were then placed on the exposed part of the hook. Because of the time required, baits were rigged before the trip was made.

Floats typically were made from lengths of two by four lumber.

Instead of high flyers with strobe lights, small floating platforms with kerosene lanterns fastened to wooden poles were used. These were placed approximately every one-quarter mile and served to mark the line, attract swordfish and, when extinguished, indicated that a fish was hooked. The main line, gangions and float lines were stored together in a wooden box. The free ends of the gangions and float lines had clips attached and these were placed in the proper sequence on metal posts fastened to the side of the box. The gear was set and hauled by hand. Figure 1C is a schematic drawing of a typical Cuban type longline.

FISHING METHODS

New England Type

The setting operation begins at sunset. Sometimes, in new areas, a test set of two to three sections is made and hauled to determine the abundance of fish before making the complete set for the night. The main line is led off the spool and a high flyer clipped to the end and cast overboard. As the boat moves ahead the main line is fed off the spool. Hooks are baited and gangions clipped to the main line as it feeds over the stern. Buoy lines are attached to buoys and clipped on the main line at the proper intervals as the line passes astern. The setting operation may take from two to four hours depending on the amount of gear being set. The entire length of main line on the spool is not always set. The line is spooled on the winch drum in sections and some sections may not be set on a particular night. Three men usually are required to bait hooks, uncoil and clip on gangions and buoy lines, prepare high flyers, and operate the winch. A fourth man steers the boat. After the longline is set, the boat drifts nearby tracking it visually or by radar. Haul-back begins at or

shortly before first light. The first buoy is picked up and the main line is attached to the spool, being fair-led from amidships. As the boat moves slowly along the line, the line is retrieved, and gangions and floats are removed as they come aboard. When hooked swordfish are brought alongside, the boat is stopped until the fish is gaffed and brought aboard. Sharks and other billfish usually are cut free. Hauling may take six hours or more. Swordfish are dressed and stored below decks on ice while the line is being hauled. Dressing consists of removing the head, tail, fins and entrails. After the haul-back, gear is repaired and made ready for another set that evening. If the catch is small the boat will move to a different area for the next set. This routine is repeated daily for up to three weeks depending on fishing success, weather, fuel use, equipment needs and vessel maintenance.

New England type longliners may fish off Florida from November to May, either off the east coast or in the Gulf of Mexico. Fish are landed at Port Canaveral, Key West, Destin, and ports in other Gulf states. Most fish landed by these boats are not sold through local dealers, and are not included in Florida landing statistics. After unloading their catch, these boats may lay over for a week or more before their next trip.

Florida Type

Florida longliners fishing on the east coast of Florida usually begin a trip in the early afternoon. Because the Florida Current will carry them 30-60 miles north during the night, they generally motor south along the coast before heading offshore.

Gear deployment is basically the same as on New England boats. The set is usually made at sunset somewhat perpendicular to the axis of the

Gulf Stream (west to east). The line is led off the spool, over the stern, and the first high flyer is attached. Gangions, floats and high flyers are snapped on in appropriate places as the boat moves slowly ahead. As the line goes out hooks are baited and "Cyalume" lights are attached with rubber bands to the leaders. Usually, all of the main line on the spool is set. Unlike New England type boats that must replace lost gear at sea or lose fishing time, Florida boats carry little extra gear, since they can repair lost gear when they return to port the next day.

When the line is set, the boat may either drift nearby or tend the line throughout the night to observe whether any floats are under strain. If a float has been pulled low or under water, the nearest float is picked up and its line pulled until the main line is reached. The boat moves slowly along the main line to the gangion with the fish. The fish is gaffed and put aboard, the hook rebaited, and the boat continues down the line. This procedure lessens shark damage which significantly lowers the value of swordfish and increases catch rates by maintaining the number of baited hooks fishing throughout the night.

At about first light the haul-back begins. The procedure is essentially the same as on New England boats. Floats are unsnapped and the float lines stored in a box, plastic can or on a spool. The snap on the end of the gangion is attached to the hook from the previous gangion and wound on a separate spool. When the hook is reached, the bait is removed and the hook is then ready to be fastened to the next gangion snap.

After the line is aboard, the fish are dressed as the boat heads back to port. If the line has been tended, the fish will have been dressed during the night. The dressed fish are covered with wet burlap or similar material and the body cavity packed with ice. Many Florida longliners do

not have fish holds, but carry large boxes on deck for ice and fish storage.

Unlike the mobile New England vessels, the Florida longliners have limited options if fishing has been poor. They may fish further inshore or offshore, change the depth of their hooks, or change their base of operation entirely, but usually they do not change their fishing area from day to day. Boats fishing one night trips usually fish every other night and frequently less often. Because most Florida longliners are relatively small, weather often keeps them in port. Although some Florida boats fish year round, total effort declines in winter. This is partly due to weather and partly because some boats choose to fish for other species (e.g. Spanish and king mackerel) in winter.

Major landing ports for Florida longliners are Port Canaveral, Fort Pierce, Pompano Beach, and Key West on the east coast and Cortez and Destin on the west coast.

Cuban Type

The Cuban system is quite different from both New England and Florida systems. Typically, a winch is not used to pull or set the line. The line, which has been faked (loosely coiled) into a box, is set by allowing it to run free over the transom as the boat moves ahead. Baits are rigged on separate leaders beforehand and clipped to the gangions as they come out of the box. Lighted platform buoys and wooden two by four floats are clipped on in proper sequence. After the gear is set, the boat drifts nearby, positioned near the middle of the line. The line is rarely more than three and one-half or four miles long, so all the kerosene lights can be seen from this location. If a fish is hooked, usually one of the platforms will

flip over, extinguishing the light. The boat moves to this platform, relights the lantern, retrieves the buoy line until the main line is reached and then moves along the main line to the gangion with the hooked fish. In addition, the boat will cruise along the line periodically throughout the night because hooked fish will not always tip over a platform. In some cases the floats, which are clipped to float lines at their ends, will be tipped from the normal, horizontal position to a vertical position by hooked fish. Hooked fish are rarely on the line for long and few fish are shark-bitten or lost by escaping the hook. In the morning, the first platform buoy is picked up, the main line is pulled by hand, and it and the gangions are faked into a box as the boat moves slowly ahead. The separate leaders are unsnapped from the gangions and buoys unsnapped from the buoy lines. The clips from the gangions and buoy lines are put on posts in the order that they come aboard.

Longline trips last one night. The catch is dressed on the return trip and left on deck, covered with wet burlap. Boats using the Cuban system fish principally out of Miami and the Florida Keys. The fishery is seasonal, lasting from April through August or September. During the remainder of the year, these boats fish for lobster or other fish. Most swordfish are sold to local dealers.

Although this system is efficient and relatively inexpensive, it is now little used. Catch rates per hook were high due to the intensive tending as well as to the use of kerosene lights, which seemed to attract swordfish (most swordfish were caught on the hooks nearest the platforms). But, it was not practical to lengthen the gear beyond three or four miles. With the introduction of the "Cyalume" light and increased competition from boats fishing more gear, the Cuban system became obsolete. Some fishermen gave up swordfishing and others switched to Florida gear.

RELATIVE EFFECTIVENESS OF THE THREE TECHNIQUES

The differences in the effectiveness of the three fishing methods can be seen in Table 1. Although the data presented for 1978 are based on only one boat in each category, the catch rates are believed to be representative. The effect of improved gear and methods for the Florida style longlines is reflected in the increasing catch rates between 1978 and 1980. The three fishing methods represent three different fishing philosophies. Basically, the New England system relies on setting many hooks in concentrations of swordfish that have been located by steaming long distances when necessary. Their terminal tackle is relatively crude and ineffective in Florida waters but because they set many hooks, their total catch may be high. The New England boats' catch rate (swordfish/100 hooks) is generally the lowest of the three methods, but they fish two to five times more hooks than the Florida boats.

The Cuban system is based on a different premise. This system relies on setting relatively few hooks but fishing them intensively. Baits are rigged carefully and the gear is tended constantly throughout the night. Boats fishing this system have the highest catch rate but because they fished relatively few hooks, their total catch is usually lower than boats fishing the other systems.

The Florida method is a compromise between the other two. It fishes more gear than the Cuban system but less than the New England boats. Catch rate is also intermediate between the New England and Cuban methods. Florida gear emphasizes the terminal rig which includes the use of light monofilament leaders, smaller hooks, and "Cyalume" lights. Most Florida longline boats do not have the mobility of the New England type boats, but because of their higher catch rates and lower operating expenses they can fish profitably in smaller concentrations of fish.

TRENDS IN THE FISHERY

The fishery for swordfish in Florida has expanded rapidly since its "discovery." Initially, the fishery was only seasonal with a few local boats fishing in the spring and summer months. The fishery now operates along both coasts on a year-round basis and is still expanding. Fishing techniques initiated in southeast Florida are now being used successfully in Georgia, the Carolinas, the Florida west coast and Texas.

The number of boats engaged in swordfishing in Florida has increased from 20 or 30 in 1974 to perhaps 200 in 1980. The average amount of gear per boat also has gone from about 4 miles and 120 hooks to 10 miles and 200 hooks, and is still increasing.

New England boats have been increasing their effort in Florida waters. Several years ago, these boats fished mainly in the Gulf of Mexico during the winter. They now fish off the east coast, usually north of Ft. Pierce, and may stay from late fall to early summer.

The Cuban fishing system, which established the fishery, is now virtually extinct. The Florida system which replaced it is still undergoing change. Some Florida longliners are beginning to stay at sea for several days with larger boats and there has been a tendency to increase the amount of gear being fished. Florida boats now move to other areas such as South Carolina during the summer or Key West or Destin during the winter when fishing slows near their home port. Movement into the Caribbean Sea may be a future development. New England boats now are adopting some Florida techniques when fishing in these waters, such as setting fewer hooks per mile and using lighter monofilament leaders.

It is not known at this time how much fishing pressure swordfish can withstand. The fleet is still expanding, both in numbers and in areas

fished. If the present rate of increase in effort is maintained, it seems inevitable that catch rates will at some point begin to decline. Without data from the entire range of the fishery, it is impossible to predict when this might occur.

* * *

Table 1. Catches and effort for the three different types of swordfish longliner fishing in the Florida Straits.

Boat Type	Dates	Number of sets	Mean no. of hooks per set	Mean no. of swordfish per set	Mean total weight of swordfish (dressed) per set (lbs)	Mean weight of fish (dressed) (lbs)	Mean no. per 100 hooks
New England	Jan-Jul 1975-1978	141	571	6.28	414.0	73.0	1.10
Cuban type	May-Oct 1978	51	90	6.10	401.1	65.8	6.77
Cuban type	Mar-Jul 1979	21	80	5.19	428.3	82.5	6.49
Florida type	Mar-Apr 1978	11	320	6.64	578.7	87.2	2.07
Florida type	Feb-Dec 1979	920	219	6.80	675.6	90.2	3.10
Florida type	Jan-Mar 1980	109	209	7.05	719.4	87.6	3.38

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